What is claimed is:

1. A method for producing a high permeability grain oriented electrical steel, comprising the steps of:

providing a band having a thickness of from about 1.5 to about 4 mm,

the band composition comprising about 2.0 to about 4.5% silicon, greater than 0.25 to about 1.2% chromium, about 0.01 to about 0.08% carbon, about 0.01 to about 0.05% aluminum and balance being essentially iron and residual elements,

the band having a volume resistivity of at least about 45 μΩ-cm, and an austenite volume fraction ($\gamma_{1150°C}$) of at least about 20 %,

annealing said hot rolled band to provide an isomorphic layer thickness of at least about 2% of the total thickness of the hot processed band,

cold rolling the band in one or more stages to provide a cold rolled strip, said cold rolling providing a final reduction of at least 80%,

annealing the cold reduced strip,

decarburization annealing the cold reduced strip sufficiently to prevent magnetic aging,

coating at least one surface of the annealed strip with an annealing separator coating, and

final annealing the coated strip to effect secondary grain growth and thereby provide a permeability measured at 796 A/m of at least 1840.

2. The method claimed in claim 1 wherein the composition comprises up to about 0.1% sulfur, up to about 0.14% selenium, about 0.03 to about 0.15% manganese, up to about 0.2% tin, and up to about 1% copper.
3. The method claimed of claim 1 wherein the isomorphic layer has a thickness of at least about 4% on at least one side of said strip.

4. The method claimed in claim 1 wherein the austenite volume is about 20 to about 40%.

5. The method claimed in claim 1 wherein the austenite volume is about 25 to about 35%.

6. The method claimed in claim 1 wherein the cold rolling is done in a single stage and the final cold reduction is at least about 85%.

7. The method claimed of claim 1 wherein a microstructure of the strip prior to the cold rolling to the final thickness consists a ferrite matrix having more than 1 vol.% of martensite and/or retained austenite and the strip prior to the cold rolling to the final thickness has a carbon content of at least 0.020%.

8. The method claimed of claim 1 wherein the volume resistivity is at least about 50 μΩ-cm.

9. The method claimed of claim 1 wherein the carbon is about 0.03% to about 0.06%.

10. The method claimed of claim 1 wherein the chromium is greater than 0.25% to about 0.75%.

11. The method claimed of claim 1 wherein the chromium is greater than 0.3% to about 0.5%.

12. The method claimed of claim 1 wherein the silicon is about 2.75% to about 3.75%.

13. The method claimed of claim 1 wherein the silicon is about 3.0% to about 3.5%.

14. The method of claim 1 wherein the aluminum is 0.02% to about 0.03%.

15. The method of claim 1 wherein the manganese is about 0.05% to about 0.09%.

16. The method of claim 1 wherein the tin is about 0.05% to about 0.1%.

17. The method of claim 1 wherein the sulfur and/or selenium is about 0.02% to about 0.03%.

18. The method of claim 1 wherein the copper is about 0.05% to about 0.15%.

19. The method of claim 1 wherein the carbon is decarburized to a level below about 0.003%.

20. The method of claim 1 wherein the annealing after the decarburizing anneal includes a rapid heating at a rate greater than about 100°C/second.

21. A method of initial annealing a high permeability grain oriented electrical steel band, said method comprising the steps of:

providing a grain oriented electrical steel band comprising about 2.0 to about 4.5% silicon, about 0.1 to about 1.2% chromium, about 0.01 to about 0.08% carbon, about 0.01 to about 0.05% aluminum, about 0.003 to about 0.013% nitrogen and balance essentially iron and residual elements,

heating said band at to a temperature greater than about 1150°C,

providing a soak for at least 1 second at a peak temperature greater than about 1150°C,

slow cooling said band from said soak temperature to temperature below about 1000°C to about 870°C, and

quenching said band at a rate greater than 30°C/second from said final slow cooling temperature at a start quench temperature to a temperature below 400°C to prevent tempering of martensite, said quench start temperature being selected based on the chromium content.

22. The method of claim 21 wherein the band is cooled at a rate greater than 20°C/second from 400°C to below 100°C.

23. The method of claim 21 wherein said band is cooled at a rate greater than 40°C/second from said final slow cooling temperature at said start quench temperature to a temperature below 400°C.

24. A method for producing a high permeability grain oriented electrical steel, comprising the steps of:

providing a band having a thickness of from about 1.5 to about 4 mm,

the band composition comprising about 2.0 to about 4.5% silicon, about 0.1 to about 1.2% chromium, about 0.01 to 0.03% carbon, about 0.01 to about 0.05% aluminum and balance being essentially iron and residual elements,

the band having a volume resistivity of at least about 45 μΩ-cm, and an austenite volume fraction ($\gamma_{1150°C}$) of at least about 20 %,

annealing said hot rolled band to provide an isomorphic layer thickness of at least about 2% of the total thickness of the hot processed band,

cold rolling the band in one or more stages to provide a cold rolled strip, said cold rolling providing a final reduction of at least 80%,

annealing the cold reduced strip,

decarburization annealing the cold reduced strip sufficiently to prevent magnetic aging,

nitriding said decarburized strip,

coating at least one surface of the annealed strip with an annealing separator coating, and

final annealing the coated strip to effect secondary grain growth and thereby provide a permeability measured at 796 A/m of at least 1840.

25. The method of claim 24 wherein said chromium content is greater than 0.25% to about 1.2%.
26. The method of claim 24 wherein said chromium content is greater than 0.30% to about 1.2%.

27. A method for producing a high permeability grain oriented electrical steel, comprising the steps of:

providing a band having a thickness of from about 1.5 to about 4 mm,

the band composition comprising about 2.0 to about 4.5% silicon, greater than 0.1 to about 1.2% chromium, about 0.02 to about 0.045% carbon, about 0.01 to about 0.05% aluminum and balance being essentially iron and residual elements,

the band having a volume resistivity of at least about 45 μΩ-cm, and an austenite volume fraction ($\gamma_{1150°C}$) of at least about 20 %,

annealing said hot rolled band to provide an isomorphic layer thickness of at least about 2% of the total thickness of the hot processed band,

cold rolling the band in one or more stages to provide a cold rolled strip, said cold rolling providing a final reduction of at least 80%,

annealing the cold reduced strip,

decarburization annealing the cold reduced strip sufficiently to prevent magnetic aging,

nitriding said decarburized strip,

coating at least one surface of the annealed strip with an annealing separator coating, and

final annealing the coated strip to effect secondary grain growth and thereby provide a permeability measured at 796 A/m of at least 1880.

28. The method of claim 27 wherein said chromium is greater than 0.25% to about 1.2%.

29. The method of claim 27 wherein said chromium is greater than 0.30% to about 1.2%